

CLAIMS

Sub B4
1. A miniature actuator comprising

- 5 - a first flux generator for generating a controllable first magnetic flux,
 - a second flux generator for generating a controllable second magnetic flux,
 - a movable diaphragm, and
 10 - means for generating a permanent magnetic flux,

wherein the movable diaphragm is positioned between the first and second flux generator,
 and wherein the movable diaphragm forms part of a magnetic flux path of the actuator
 15 and thereby being movable in response to the generated first and second magnetic
 fluxes.

2. A miniature actuator according to claim 1, wherein the first flux generator comprises a
 conductive path formed as a first coil having a first centre, said conductive path being
 20 adapted to guide a first alternating current.

3. A miniature actuator according to claim 2, wherein the second flux generator comprises
 a conductive path formed as a second coil having a second centre, said conductive path
 being adapted to guide a second alternating current.

25 4. A miniature actuator according to claim 3, wherein the first and second coils are em-
 bedded into a polymer material.

5. A miniature actuator according to claim 3, wherein the first and second coils are con-
 30 nected in series or in parallel producing a magnetic flux in opposite direction.

6. A miniature actuator according to claim 3, wherein the means for generating the per-
 manent magnetic flux through the movable diaphragm comprises permanent magnets po-
 sitioned on both sides of the movable diaphragm.

7. A miniature actuator according to claim 3, wherein the means for generating the permanent magnetic flux through the movable diaphragm is positioned symmetrically around a centre axis defined by the first and second centres.

8. A miniature actuator according to claim 6, wherein the permanent magnets are formed as ring magnets, said ring magnets forming part of a housing of the actuator.

9. A miniature actuator according to claim 6, wherein the permanent magnets are formed as bar magnets, said bar magnets being positioned at the centre axis defined by the first and second centres.

10. A miniature actuator according to claim 6, wherein the permanent magnets comprise electroless- or electrochemical deposited material selected from the group consisting of Fe, Cr, Co, Ni, Pt, V, Mn, Bi or any combination thereof.

11. A miniature actuator according to claim 1, wherein the movable diaphragm comprises a material for adjusting the magnetic properties of the movable diaphragm, said material being selected from the group consisting of Ni, Fe, Co, Cu, Cr, Mo or any combination thereof.

12. A miniature actuator according to claim 3, wherein the conductive paths of the first and second coils comprise electroplated Cu, Au or Ag or any combination thereof.

13. A miniature actuator according to claim 6, wherein the first or second permanent magnet comprises an opening so as to form a sound outlet.

14. A miniature actuator according to claim 13, wherein the sound inlet opening has a substantially circular shape, and is positioned symmetrically around the centre axis defined by the first and second centres.

15. A mobile unit comprising a miniature actuator according to claim 1.

16. A mobile unit according to claim 15, wherein the mobile unit is a hearing instrument.

17. A mobile unit according to claim 15, wherein the mobile unit is a mobile or cellular phone.

18. A movable diaphragm for a miniature actuator, said movable diaphragm comprising, in
5 a plane of the diaphragm,

- a substantially stiff centre part,
- a resilient outer part surrounding the substantially stiff centre part,

10 wherein the movable diaphragm shows predetermined magnetic properties, said predetermined magnetic properties varying across the substantially stiff centre part and the resilient outer part so as to avoid saturation effects of the movable diaphragm when the movable diaphragm is positioned in a magnetic flux that varies in the plane of the diaphragm.

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19. A movable diaphragm according to claim 18, wherein the magnetic properties of the movable diaphragm varies according to a varying thickness of the diaphragm.

20. A movable diaphragm according to claim 18, wherein the magnetic properties of the
20 movable diaphragm varies according to the properties of an added material.

21. A movable diaphragm according to claim 20, wherein the added material is selected from the group consisting of Ni, Fe, Co, Cu, Cr, Mo or any combination thereof.

25 22. A movable diaphragm according to claim 18, further comprising a plurality of canals adapted to guide air from the centre part of the movable diaphragm to the outer part of the movable diaphragm so as to reduce/minimise squeeze film damping effects.